

The Role of Process Innovation between Organizational Capability and Software Project Success in Malaysian Public Sector

M. D. Rozaida*

Faculty of Industrial Management University Malaysia Pahang, Malaysia

Mahanum Daim

Faculty of Industrial Management University Malaysia Pahang, Malaysia

Abstract

This study used the partial least square (PLS) and structural equation modeling (SEM) tool to examine factors influencing the process innovation of the organization capability in public sectors. It also measures the impact of process innovation on the success of software project process. Statistical results confirm that coordination of expertise, communication plan and IT infrastructure reach impact on process innovation while process innovation in turn positively influences the success of software project success. The result, besides indicating the suitability of the PLS in statistical analysis, has also contributed to a better understanding of the success of the software project process. Findings are useful for IT Managers and practitioners to improve the success of software project in Malaysian public sectors. Limitation and suggestion for future research are also included.

Keywords: Coordination of expertise, Communication plan, IT infrastructure reach; Organizational capability; process innovation; success of software project process.



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1. Introduction

ICT spending has resulted in large and complex computing environments which have become overly expensive to operate, maintain and provide very little strategic value or return (Raup-Kounovsky *et al.*, 2010; Teo and Ang, 1999). Further, it becomes very difficult to predict the success of project because the scope of the project keeps changing depending upon the market; hence the resources have to be re-allocated leading to schedule slippage and cost overruns. Consequently, not only the project manager, but the others such as the top management, software developer and stakeholders are in distress when software projects are delayed in delivery, overrun cost, insufficient quality, do not meet user requirements and less customer satisfaction (Masateru, 2010). This paper attempts to examine the success of software project from a multidisciplinary approach using quantitative technique within social science discipline which focuses on the social psychology of relationships incorporating elements of strategic management, business and technology.

In Malaysia, presently, more than 500 major IT systems have been developed and used in various government ministries, departments and agencies to improve the delivery of public sector services (National Audit Department of Malaysia, 2015; Ramli *et al.*, 2018). Software projects can be viewed from various perspectives and categorised as failures if they are unable to meet user requirements, exceed development time, exceed their allocated budget or if the projects once implemented are not utilised or instead are abandoned (Janssen and Klievink, 2010). For example, the Health Ministry of Malaysia terminated its contract with a company for a project that was developing a Pharmacy Enforcement Management System (PEMS) and a Pharmacy Management System (PMS), for failing to develop both systems. In this case, almost RM2.59 million that was spent towards these systems was considered not to be 'value for money' (i.e. money not well spent) (Bernama, 2012). Furthermore, according to the Attorney-General's report in 2006, the Customs Department spent RM290 million for a system which was subsequently underutilised. In this case, the Deloitte Consulting firm was appointed to prepare a plan in the vicinity of RM451 million to develop the solution (Lee, 2007). These issues are not unique or uncommon, and many of these failed projects cost governments' billions.

Thus, Malaysia should redesign and restructure its public sector current systems and processes for a sustainable development and maintaining its competitive advantage (Ali and Buang, 2016). Based on resource based view (RBV), assumes that a firm possesses or control a pool of resources and capabilities (Asad *et al.*, 2018b; Gunday *et al.*, 2011; Newbert, 2008), and that these resources and capabilities, which are different in different organization, create competitive advantages which can improve a firm's performance (Amit and Schoemaker, 1993). According to Cohn (2013), the implementation of innovation contribute for organization to achieve competitive which helps organization to minimize other issues related to cost and resources, create value, maintain competitive position in the market and sustain for long term prosperity. For example, in the manufacturing industry (Boujelben and Fedhila, 2010), information and technology (Rajala and Westerlund, 2008; Waychal *et al.*, 2011), small and medium enterprises (SMEs) (Piperopoulos and Scase, 2009), defence industry (Borjesson and Elmquist, 2012) and pharmaceutical (Asad *et al.*, 2018b; Chaturvedi and Chataway, 2006; Subramanian *et al.*, 2011). This shows that innovations can assist organizations to defend and strengthen their organizations in the market. Besides, innovation

*Corresponding Author

is source of competitive advantage (Asad *et al.*, 2018a; Bresciani, 2009; Erekson *et al.*, 2008). This paper attempts to examine the determinant of process innovation and the success of software project process in the Malaysian public sector which hitherto has not been tested.

The next section of this paper discusses the research context and conceptual model in relation of existing literature on the organizational capability and relational construct such as coordination of expertise, communication plan and IT infrastructure reach. This is followed by an explanation of the research method used and assessment of goodness of measures, namely, the construct validity, convergent validity, discriminant validity and reliability of the constructs. Subsequent sections deal with data analysis, path analysis and hypotheses testing. The last section is on discussion and conclusion with suggestions for future research.

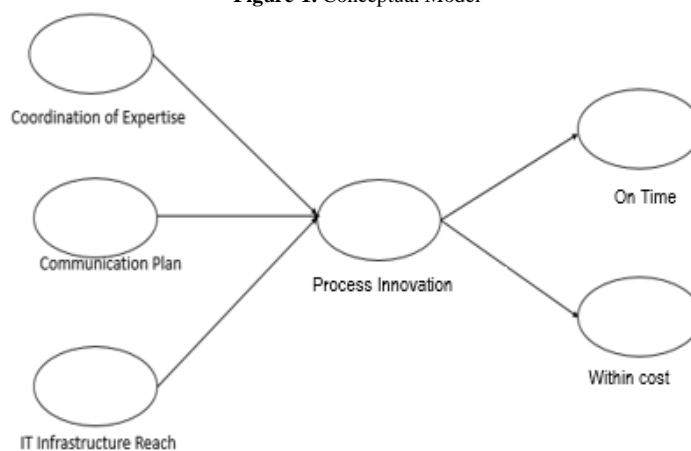
2. Research Context and Conceptual Model

2.1. Organizational Capability and Process Innovation

The notion of organizational capabilities has been developed within the resource-based view of the firm (Barney J. B., 1991; Hunt and Morgan, 1996). Organizational capabilities are defined as an organization's capacity to deploy its assets, tangible or intangible, to perform a task or activity to improve the performance (Maritan, 2001). Barney J. (2002) defines organizational capabilities as the firm attributes that enable organizations to coordinate and utilize their resources. Eisenhardt and Martin (2000) define dynamic capabilities as "the firm processes that use resources to match and even create market change". The distinction between resources and capabilities is the source of the uniqueness of firms across the market. Although many researchers have used different terms, such as "combinative capabilities" (Kogut and Zander, 1992), capabilities (Amit and Schoemaker, 1993), "architectural competence" (Cockburn and Henderson, 1994), and "dynamic capabilities" (Eisenhardt and Martin, 2000), the definitions for these terms all have to do with firm processes that use specific resources, integrate these resources together, reconfigure them and release new resources of competitive advantage (Tuan and Yoshi, 2010).

In this research, the theoretical works of RBV (Grant, 1991;2002) is suggested which attempts to conceptualize a comprehensive framework of relationships among resources, organizational capabilities and competitive advantage. According to Grant (2002) the basic and primary inputs into organizational processes were tangible, intangible and human. Nonetheless, in organization, the resources are not as productive on their own. For the organization to create competitive advantage, individual resources must work together to initially establish. The literature also lends support for the formulation of the research framework for examining the relationship between coordination of expertise, communication plan, IT infrastructure reach, process innovation and the success of software project process which are on time and within cost. (see Figure 1)

Figure-1. Conceptual Model



2.2. IT Infrastructure Reach

Reach of IT infrastructure refers to the degree to which technical IT capability fulfils the basic requirements of a project's team (Xia, 1998). Keen (1991) refers IT reach to which the various IT components or business functions are connected through IT infrastructure. Duncan (1995) operationalized IT reach in terms of connectivity and sharable of IT infrastructure components (e.g., computer platforms, networks, data, and applications). In addition, Broadbent and Weill (1997) suggested that connectivity with customers and suppliers may also need to be considered in measuring the reach of IT infrastructure. These business needs demand an IT infrastructure that ensures platform compatibility, data transparency, and network connectivity among the various business units (Duncan, 1995).

Several studies have examined the macro-level impact of IT infrastructure capabilities on business process agility (Tallon, 2008), competitive advantages (Bhatt and Grover, 2005) and Chen and Tsou (2007) and organization performance. For example, Law and Ngai (2007) found that IT infrastructure capabilities are positively related to business process improvement. Furthermore, as organizations are rapidly adopting new technologies in an attempt to gain competitive advantage (El and Madhavji, 1995), its positive performance implication are expected. Therefore,

process innovation may also increase the effectiveness and efficiency of operations. It follows that organisations that constantly innovate service process would excel at utilizing new marketing technique and enhancing customer satisfaction to fulfil the constantly change needs of their customers. Thus, the present study propose the following hypotheses:

H1IT Infrastructure Reach in organization has a direct positive effect on the process innovation.

2.3. Coordination of Expertise

Coordination of expertise can be broadly defined as the level of the management on knowledge and skill dependencies (Faraj and Sproull, 2000). This include knowing where a certain expertise is situated within a team, recognizing the needs for the expertise and bring it to a good use. As studies have indicated, organisations and teams need to coordinate their members' expertise in order to create value and achieve project objectives (Faraj and Sproull, 2000; Tiwana and McLean, 2005).

Besides, experts bring their knowhow together (often expertise that is drawn from various disciplines and is based on years of experience) to innovate new concepts, products, and processes. In doing so, the integration of expertise attempts to address future needs (business transformation and innovation) rather than solving present problems (maintenance). In line with the literature on knowledge integration by Grant (1996), the integration of expertise facilitates the organisation's ability to sense, interpret, and respond to new opportunities. This lead to the following hypothesis:

H2Coordination of expertise in organization has a direct positive effect on the process innovation.

2.4. Communication Plan

Project management Institute (Project Management Institute (PMI), 2000) defines it as the degree to which the information and communication needs of the stakeholders are determined. It is concerned with the decision of the target audience, time, message, and the methods as its guidelines. Fransson and Lundgren (2011) cited in Brown and Hyer (2010) designed a plan for a project group communication which may act as a tool to get the right stakeholders the right information at the right time. By planning in advance the risk of mistakes and irritation from stakeholders is decreased (Tonquist, 2008). To plan for the future, communication processes can make resources more easily attained but also to decrease uncertainty from the customer of the project. It can also contribute to the result of the project and information of change progress is more easily distributed (Macheridis, 2009).

The communications plan should be linked directly to the overall strategic plan of an organization, to best inform the decisions of staff (Hume, 2007), promote change competence and innovation (Ragusa, 2010), and sharing of internal best practices coupled with better coordination of internal projects and processes (Koelen and Van, 2004). Thus, the present study includes the following hypothesis:

H3Communication plan in organization has a direct positive effect on the process innovation.

2.5. Process Innovation and the Success of Software Project Process

Process innovation refers to the level of changes in techniques, equipment and software which intended to reduce cost, increase quality and deliver new or improved product (OECD, 2005). Process innovation is considered as an important source of increased efficiency and can enable organisations to gain competitive advantage (Reichstein and Salter, 2006). Many empirical studies showed that innovation capability is the most important factor of organisation's performance and diffusion of innovations literature suggests that organisations must be innovative to gain a competitive edge in order to survive (Calantone *et al.*, 2002). Prior studies on innovation normally reported a positive relationship between innovation and organisation's performance (Gunday *et al.*, 2011). Even though innovation is generally concerned as a means of improving the organisation's competitiveness and performance, this relationship has not been supported explicitly by empirical work (Hashi and Stojčić, 2012).

Previous studies indicate that topic of project success can be provided by four-level project success framework (Shenhar *et al.*, 1997); (Baccarini, 1999); (Howsawi *et al.*, 2014). In particular, by highlighting the effect of a project process that is referring to Howsawi *et al.* (2014) on the definition of its success within the specific time and budget. In this research, the success of software projects in Malaysia's public sector was investigated by looking at their allocated time and budget as their outcomes were reached. On time specifies the level of defining scheduling, monitoring and controlling project task to be completed within intended time (Project Management Institute PMI, 2013). Whilst, within cost identify the level of estimating, budgeting and controlling project cost to be completed within the approved budget (Project Management Institute PMI, 2013).

Concerning the relationship between innovation and performance of the organisation, literatures have described the innovation as an immediate source of competitive advantage which can lead to an improvement in performance (Camisón and Villar-López, 2012). Organisations that perform well may have easier access to capital to finance for further innovations and investments (Koellinger, 2008).

H4Process innovation is positively related with on time of software project process.

H5Process innovation is positively related with on budget of software project process.

According to Newbert (2008), whose argument used (Barney J. B., 1991), and Castanias and Helfat (2001), as its foundation, an organization must identify and implement RBV strategies to create economic value. Newbert (2008) also suggested that to produce a product or service with more benefits (for example, in the form of unique features and/or lower cost than are associated with the products or services of its competitors, a firm must exploit a combination of valuable resource and capabilities greater than that of its competitors. It is hypothesized that no matter what processes of resources and capabilities are, they only indirectly affect performance. In other words, to

generate benefits from its resource-capability combination, a firm must first obtain a competitive advantage deriving from its exploitation (Newbert, 2008). Empirical testing supported this hypothesis. Considering the organizational capabilities as output that derives from specific resources and/or capabilities and their processes (Grant, 2002), it is also hypothesized that the competitive advantage resulting from the organizational capabilities determines the success of a firm.

H6The impact of IT infrastructure reach and on time of software project process is mediated by the process innovation.

H7The impact of coordination of expertise and on time of software project process is mediated by the process innovation.

H8The impact of communication and on time of software project process is mediated by the process innovation.

H9The impact of IT infrastructure reach and within cost of software project process is mediated by the process innovation.

H10The impact of coordination of expertise and within cost of software project process is mediated by the process innovation.

H11The impact of communication and within cost of software project process is mediated by the process innovation.

3. Research Method

The unit of analysis in this study is IT Managers in Malaysia public sector. IT Managers were involved in software development projects. Based on the general rule, the minimum number of respondents or sample size is five-to-one ratio of the number of independent variables to be tested. However, Hair *et al.* (2010) proposed that the acceptable ratio is ten-to-one. Non-probability purposive sampling was used in this study. Since we could not get a list of all the elements of the population, we used a non-probability sampling of purposive sampling whereby only IT Managers that handled the software development project were chosen.

3.1. Data Collection

Two hundred and fifty self-administered questionnaires were used for gathering data from the respondents. A multiple method of data collection was employed, whereby some questionnaires were mailed to the respondents, some e-mailed and some were personally administrated. The process of distribution and collection of questionnaires was carried out over a period of 3 months. A total of 228 questionnaires were received and used for this analysis which translates to about a 91.2% response rate. The next section presents the assessment of the goodness of measure of these constructs in terms of their validity and reliability within the research framework.

3.2. Measures and Assessment of Goodness of Measures

A questionnaire using a seven-point Likert scale was used to gather data for each construct of the research model. All instruments were adapted from previous literatures and were modified to measure the success of the software project performance. Constructs have been operationalized in a multi item construct to ensure a comprehensive evaluation and at the same time avoid the drawbacks of using a single item measure (White and Fortune, 2002). The questionnaires were designed by adapting from previous studies namely Project Management Institute PMI (2013), Gunday *et al.* (2011), Xia (1998), Faraj and Sproull (2000), (White and Fortune, 2002).

3.3. Goodness of Measures

The two main criteria used for testing goodness of measures are validity and reliability. Reliability is a test of how consistently a measuring instrument measures whatever concept is measuring, whereas validity is a test of how well an instrument that is developed measures the particular concept it is intended to measure (Sekaran and Bougie, 2010)

3.4. Construct Validity

Construct validity testifies on how well the results obtained from the use of the measure fit the theories around which the test is designed (Sekaran and Bougie, 2010). First, we looked at the respective loadings and cross loadings from Table 1 to access if there are problems with any particular items. We used a cutoff value for loadings at 0.5 as significant (Hair *et al.*, 2010). As such, if any items which has a loading of higher than 0.5 on two or more factors then they will be deemed to be having significant cross loadings.

3.5. Convergent Validity

The convergent validity is the degree to which multiple items to measure the same concept are in agreement. As suggested by Hair *et al.* (2010) we used the factor loadings, composite reliability and average variance extracted to assess convergence validity. The loadings for all items exceeded the recommended value of 0.5 (Hair *et al.*, 2010). Composite reliability values (see Table 2), which depict the degree to which the construct indicate the latent, construct range from 0.901 to 0.946 which exceeded the recommended value of 0.7 (Hair *et al.*, 2010). The average variance extracted (AVE) measures the variance captured by the indicators relative to measurement error, and it should be greater than 0.50 to justify using a construct (Barclay *et al.*, 1995). The average variance extracted, were in the range of 0.646 to 0.776.

Table 3 summarizes the results of the measurement model. The results show that all the six constructs coordination of expertise, communication plan, IT infrastructure reach, on time, within cost, process innovation and

within cost are all valid measures of their respective constructs based on their parameter estimates and statistical significance (Chow and Chan, 2008).

3.6. Discriminant Validity

The discriminant validity of the measures (the degree to which items differentiate among constructs or measure distinct concepts) was assessed by examining the correlations between the measures of potentially overlapping constructs. Items should load more strongly on their own constructs in the model, and the average variance shared between each construct and its measures should be greater than the variance shared between the construct and other constructs (Compeau *et al.*, 1999). As shown in Table 4, the squared correlations for each construct are less than the average extracted by the indicators measuring that construct indicating adequate discriminant validity. In total, the measurement model demonstrated adequate convergent validity and discriminant validity.

Table-1. Loading and cross loadings

	Coordination of Expertise	Communication Plan	IT Infrastructure Reach	On Time	Process Innovation	Within Cost
Co_Expertise1	0.777	0.438	0.386	0.434	0.380	0.230
Co_Expertise2	0.878	0.549	0.453	0.513	0.478	0.295
Co_Expertise3	0.889	0.517	0.458	0.486	0.490	0.354
Co_Expertise4	0.859	0.519	0.435	0.440	0.481	0.348
Co_Expertise5	0.826	0.473	0.414	0.455	0.447	0.390
Comm_Plan1	0.529	0.867	0.539	0.532	0.505	0.367
Comm_Plan2	0.509	0.874	0.536	0.513	0.537	0.389
Comm_Plan3	0.546	0.894	0.519	0.551	0.540	0.333
Comm_Plan4	0.482	0.843	0.462	0.463	0.482	0.342
Comm_Plan5	0.522	0.903	0.494	0.584	0.471	0.336
ITReach1	0.348	0.478	0.871	0.444	0.520	0.341
ITReach2	0.380	0.523	0.908	0.458	0.518	0.350
ITReach3	0.482	0.525	0.909	0.483	0.546	0.365
ITReach4	0.539	0.525	0.832	0.522	0.500	0.460
ITReach5	0.480	0.507	0.860	0.511	0.524	0.387
On_Time1	0.506	0.584	0.504	0.908	0.468	0.477
On_Time2	0.430	0.506	0.446	0.894	0.459	0.507
On_Time3	0.434	0.537	0.518	0.875	0.429	0.458
On_Time4	0.506	0.494	0.436	0.866	0.413	0.457
On_Time5	0.546	0.535	0.522	0.862	0.467	0.495
Process_Inno1	0.446	0.468	0.489	0.450	0.835	0.449
Process_Inno2	0.433	0.504	0.532	0.456	0.872	0.400
Process_Inno3	0.419	0.411	0.421	0.373	0.794	0.443
Process_Inno4	0.502	0.579	0.526	0.438	0.873	0.425
Process_Inno5	0.477	0.479	0.539	0.426	0.844	0.365
Within_Cost1	0.412	0.363	0.359	0.442	0.490	0.804
Within_Cost2	0.314	0.354	0.378	0.509	0.306	0.757
Within_Cost3	0.261	0.276	0.334	0.407	0.376	0.845
Within_Cost4	0.317	0.352	0.361	0.478	0.415	0.865
Within_Cost5	0.208	0.270	0.313	0.357	0.348	0.738

Bold values are loadings for items which are above the recommended value of 0.5

Table-2. Loading and cross loadings

Model Construct	Measurement Item	Loading	CR ^a	AVE ^b
Coordination of Expertise	Co_Expertise1	0.777	0.927	0.717
	Co_Expertise2	0.878		
	Co_Expertise3	0.889		
	Co_Expertise4	0.859		
	Co_Expertise5	0.826		
Communication Plan	Comm_Plan1	0.867	0.943	0.768
	Comm_Plan2	0.874		
	Comm_Plan3	0.894		
	Comm_Plan4	0.843		
	Comm_Plan5	0.903		
IT Infrastructure Reach	ITReach1	0.871	0.943	0.768
	ITReach2	0.908		
	ITReach3	0.909		

	ITReach4	0.832		
	ITReach5	0.860		
On Time	On_Time1	0.908	0.946	0.776
	On_Time2	0.894		
	On_Time3	0.875		
	On_Time4	0.866		
	On_Time5	0.862		
Process Innovation	Process_Inno1	0.835	0.925	0.712
	Process_Inno2	0.872		
	Process_Inno3	0.794		
	Process_Inno4	0.873		
	Process_Inno5	0.844		
Within Cost	Within_Cost1	0.804	0.901	0.646
	Within_Cost2	0.757		
	Within_Cost3	0.845		
	Within_Cost4	0.865		
	Within_Cost5	0.738		

^a Composite reliability (CR) = (square of the summation of the factor loadings)/{(square of the summation of the factor loadings) + (square of the summation of the error variances)}

^b Average variance extracted (AVE) = (summation of the square of the factor loadings)/{(summation of the square of the factor loadings) + (summation of the error variances)}

Table 3 summarizes the results of the measurement model. The results show that all the six constructs coordination of expertise, communication plan, IT infrastructure reach, on time, within cost, process innovation and within cost are all valid measures of their respective constructs based on their parameter estimates and statistical significance (Chow and Chan, 2008).

Table-3. Summarizes results of the measurement model

Model Construct	Measurement Item	Std. Estimation	T-value
Coordination of Expertise	Co_Expertise1	0.777	20.14
	Co_Expertise2	0.878	54.89
	Co_Expertise3	0.889	58.70
	Co_Expertise4	0.859	43.58
	Co_Expertise5	0.826	28.93
Communication Plan	Comm_Plan1	0.867	36.02
	Comm_Plan2	0.874	38.37
	Comm_Plan3	0.894	53.17
	Comm_Plan4	0.843	37.18
	Comm_Plan5	0.903	60.44
IT Infrastructure Reach	ITReach1	0.871	43.14
	ITReach2	0.908	65.38
	ITReach3	0.909	58.97
	ITReach4	0.832	25.69
	ITReach5	0.860	38.42
On Time	On_Time1	0.908	65.14
	On_Time2	0.894	49.53
	On_Time3	0.875	35.37
	On_Time4	0.866	35.97
	On_Time5	0.862	41.76
Process Innovation	Process_Inno1	0.835	34.80
	Process_Inno2	0.872	43.67
	Process_Inno3	0.794	23.37
	Process_Inno4	0.873	59.89
	Process_Inno5	0.844	31.98
Within Cost	Within_Cost1	0.804	28.39
	Within_Cost2	0.757	9.12
	Within_Cost3	0.845	29.30
	Within_Cost4	0.865	39.52
	Within_Cost5	0.738	18.24

Table-4. Discriminat validity of construct

Constructs	1	2	3	4	5	6
1. Coordination of Expertise	0.847					
2. Communication Plan	0.591	0.876				
3. IT Infrastructure Reach	0.508	0.584	0.876			
4. On Time	0.550	0.604	0.551	0.881		
5. Process Innovation	0.540	0.581	0.595	0.508	0.844	
6. Within Cost	0.385	0.404	0.433	0.544	0.493	0.803

Diagonals (in bold) represent the average variance extracted while the other entries represent the squared correlations

3.7. Reliability Analysis

We used the Cronbach's alpha coefficient to assess the inter item consistency of our measurement items. Table 5 summarizes the loadings and alpha values. As seen from Table 5, all alpha values are above 0.6 as suggested by Nunally and Berstein (1994). The composite reliability values also ranged from 0.901 to 0.946. Interpreted like a Cronbach's alpha for internal consistency reliability estimate, a composite reliability of 0.70 or greater is considered acceptable (Fornell and Larcker, 1981). As such we can conclude that the measurement are reliable.

Due to the self-reported nature of the data, there was a potential for common method variance, and so the Harman one-factor test was conducted to determine the extent of this. The common method bias can be attributed by raters (e.g. consistency motif and social desirability), item characteristics (e.g. complex and ambiguous items) and context (e.g. context induced mood), and measurement context (e.g. time and location of measurement, common medium to obtain measurement) (Podsakoff *et al.*, 2003). According to Podsakoff and Organ (1986), common method bias is problematic if a single latent factor would account for the majority of the explained variance. The un-rotated factor analysis is showed that the first factor accounted for only 45% variance explained by a single factor shows that the common method bias is not a major concern in this study (less than 50% cut-off point). The result is obtained by running un-rotated, a single factor constraint of factor analysis in SPSS statistic.

Table-5. Result of reliability test

Constructs	Measurement Item	Cronbach's α	Loading range	No of items
Coordination of Expertise	Co_Expertise1, Co_Expertise2, Co_Expertise3, Co_Expertise4, Co_Expertise5	0.901	0.777-0.889	5
Communication Plan	Comm_Plan1, Comm_Plan2, Comm_Plan3, Comm_Plan4, Comm_Plan5	0.924	0.843-0.903	5
IT Infrastructure Reach	ITReach1, ITReach2, ITReach3, ITReach4, ITReach5	0.924	0.832-0.909	5
On Time	On_Time1, On_Time2, On_Time3, On_Time4, On_Time5	0.928	0.862-0.908	5
Process Innovation	Process_Inno1, Process_Inno2, Process_Inno3, Process_Inno4, Process_Inno5	0.899	0.794-0.872	5
Within Cost	Within_Cost1, Within_Cost2, Within_Cost3, Within_Cost4, Within_Cost5	0.863	0.738-0.865	5

3.8. Hypotheses Testing

Next, we proceeded with the path analysis to test the five hypotheses generated. Figure 2 and Table 6 present the result. The R^2 value was 0.466 suggesting that 46.6% of the variance in extent of process innovation can be explained by coordination of expertise, communication plan and IT infrastructure reach.

Figure-2. Result of the path analysis

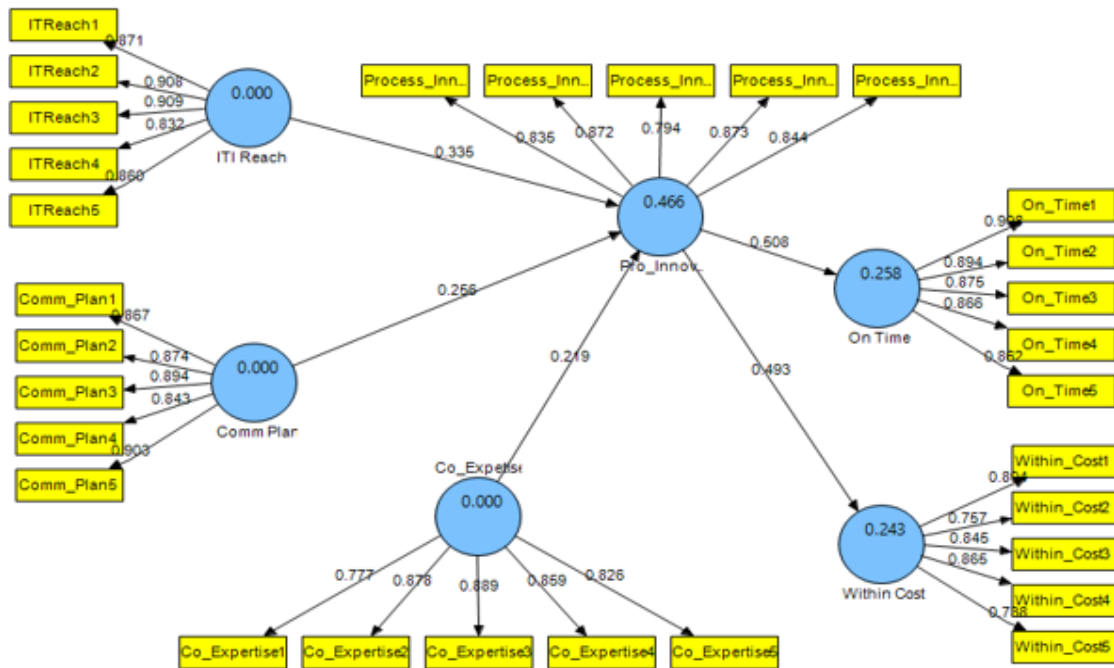


Table-5. Result of reliability test

Constructs	Measurement Item	Cronbach's α	Loading range	No of items
Coordination of Expertise	Co_Expertise1, Co_Expertise2, Co_Expertise3, Co_Expertise4, Co_Expertise5	0.901	0.777-0.889	5
Communication Plan	Comm_Plan1, Comm_Plan2, Comm_Plan3, Comm_Plan4, Comm_Plan5	0.924	0.843-0.903	5
IT Infrastructure Reach	ITReach1, ITReach2, ITReach3, ITReach4, ITReach5	0.924	0.832-0.909	5
On Time	On_Time1, On_Time2, On_Time3, On_Time4, On_Time5	0.928	0.862-0.908	5
Process Innovation	Process_Inno1, Process_Inno2, Process_Inno3, Process_Inno4, Process_Inno5	0.899	0.794-0.872	5
Within Cost	Within_Cost1, Within_Cost2, Within_Cost3, Within_Cost4, Within_Cost5	0.863	0.738-0.865	5

A close look shows that communication plan was positively related ($\beta = 0.219, p < 0.01$) to extent of process innovation, coordination of expertise was positively related ($\beta = 0.256, p < 0.01$) and so was IT infrastructure reach ($\beta = 0.335, p < 0.01$). Thus, H1, H2 and H3 of this study were positively related to extend of process innovation. Meanwhile, H4 and H5 were also supported as the R^2 value of process innovation positively related to extend on time ($\beta = 0.258, p < 0.01$) and within cost ($\beta = 0.243, p < 0.01$). As a result, hypothesis H1, H2, H3, H4 and H5 are supported.

The mediation analysis in this study is followed (Preacher and Hayes, 2004;2008) where they have introduced a new method by bootstrapping the sampling distribution of the indirect effect. Once, we run the bootstrapping we will get the bootstrapped result, i. e.; 500 for each of the direct relationships for the direct effects. Next, we need to create the bootstrapped indirect effects by taking the product of each indirect effect. The empirical t-value of the indirect effect of the process innovation needed to be calculated in order to know whether or not the indirect effect was significant (i.e., t-value = indirect effect size/bootstrap standard deviation).

Next we need to calculate the bootstrapped indirect effect Standard Errors (SE) for each of five indirect effects. The SE value of the indirect effects was calculated by copying and pasting the path coefficient results in the MS Excel spreadsheet application. The STDEV function was used to execute the standard deviation value for the indirect effect (500 values). We use the function STDEV to calculate the standard error as the data is already standardize in Smart-PLS. Then we apply the SE in the calculation of the t-values.

Table 5.10 shows the result of the mediator analysis where the indirect effect of $\beta=0.111, \beta=0.130, \beta=0.170, \beta=0.108, \beta=0.126$ and $\beta=0.165$ were significant with t-values of 2.675, 2.997, 4.134, 2.764, 3.161 and 4.064 with the significance level of 95%. Meanwhile, the indirect effect of $\beta=0.097, \beta=0.094$ were significant with t-values of 0.171

and 0.172 with the significance level of 90%. Also as indicated by Preacher and Hayes (2008) the indirect effects of 95% bootstrapping Confidence Interval, CI: [LL = 0.030, UL = 0.193], [LL = 0.045, UL = 0.215], [LL = 0.090, UL = 0.251], [LL = 0.048, UL = 0.204] and [LL = 0.085, UL = 0.245]. The bootstrapping Confidence Interval does not straddle a 0 in between therefore, we can conclude that the mediation effect is statistically significant. Based on Table 6 we can conclude that all the six mediation were significant.

Table-6. Path coefficient hypothesis testing

Hypothesis	Relationship	Std Beta β	Std Error	t-value	Result
H1	Coordination of Expertise -> Process Innovation	0.219	0.077	2.849	YES
H2	Communication Plan -> Process Innovation	0.256	0.081	3.157	YES
H3	IT Infrastructure Reach -> Process Innovation	0.335	0.074	4.516	YES
H4	Process Innovation -> On Time	0.508	0.053	9.551	YES
H5	Process Innovation -> Within Cost	0.493	0.050	9.838	YES
H6	Coordination of Expertise -> Process Innovation -> On Time	0.111	0.042	2.675	YES
H7	Communication Plan -> Process Innovation -> On Time	0.130	0.043	2.997	YES
H8	IT Infrastructure Reach -> Process Innovation -> On Time	0.170	0.041	4.134	YES
H9	Coordination of Expertise -> Process Innovation -> Within Cost	0.108	0.039	2.764	YES
H10	Communication Plan -> Process Innovation -> Within Cost	0.126	0.040	3.161	YES
H11	IT Infrastructure Reach -> Process Innovation -> Within Cost	0.165	0.041	4.064	YES

4. Discussion and Conclusion

This study supports conventional views of the influence of independent variables of coordination of expertise, communication plan and IT infrastructure reach on the perceived extent of process innovation in software project process in Malaysian public sector using the Partial Least Square (PLS) techniques in testing hypotheses. It also examines how this perceived extent of process innovation may predict the software development project success as on time and within cost. As extent of process innovation is also an intervening variable in the study, an attempt is made to access its mediating effect on organizational capabilities which is on coordination of expertise, communication plan and IT infrastructure reach in the overall model. The paper also examines the goodness of measure which is assessed by looking at the validity and reliability of the measures carried out using the PLS approach. The results showed that the measures used exhibited both convergent and discriminant validity. Next, we proceeded to assess the reliability of the measures by looking at the Cronbach alpha values and composite reliability values. Both the Cronbach alpha values and composite reliability values were at par with the criteria set up by other researchers. As such the measures in the model were shown to be reliable.

The finding of this paper confirmed views that coordination of expertise, communication plan and IT infrastructure reach impact on process innovation in the organization. This corroborates with viewed from the RBV perspective, the IT infrastructure provides the resources that make feasible innovation and continuous improvement of products (Duncan, 1995). The high implementation of IT infrastructure reach, the better result of process innovation in software development project. This is aligned with the study by Law and Ngai (2007) where they found that IT infrastructure capabilities are positively related to business process improvement. Hence, IT infrastructure reach can improve the efficiency of operational process through automation or enhance their effectiveness through meets their project's team needs.

Coordination of expertise too has an influence on the process innovation in software project process. Successful coordination of expertise leads to higher levels of productivity, satisfaction with the process, and satisfaction with the product (Andres and Zmud, 2002; Jiang *et al.*, 2006). The findings show that there is a positive significant relationship between coordinaton of expertise and process innovation. By bringing all the experts together, it will affect the process innovation in the organization to become more competitive in order to innovate new concepts, product and process. This is aligned with previous studies where organizations and teams need to coordinate their members' expertise in order to create value and achieve project objectives (Faraj and Sproull, 2000; Rus and Lindvall, 2002; Tiwana and McLean, 2005). Therefore, in today's rapidly changing business environment, an organization's ability to create and share knowledge is important for establishing and sustaining competitive advantage (Teece *et al.*, 1997).

The communication plan in organizational capability is associated with process innovation. There is a positively significant between communication plan and process innovation in achieving competitive advantage in the organization. This is aligned with previous studies where communications plan should be linked directly to the overall strategic plan of an organization, to best inform the decisions of staff (Hume, 2007), promote change competence and innovation (Ragusa, 2010) and also sharing of internal best practices coupled with better coordination of internal projects and processes (Koelen and Van, 2004). By using more frequently and more

effectively of formal project communication plans, allowing organization to successfully operate in a complex and competitive climate.

Organizations are rapidly adopting new technologies in an attempt to gain competitive advantage (El and Madhavji, 1995). Therefore, to support process innovation, a suitable IT infrastructure in general has been identified as one key success factor (Broadbent *et al.*, 1999). The finding shows that the high implementation of IT infrastructure reach in organization, the better result of process innovation in developing software. This is aligned with the study by Law and Ngai (2007) where they found that IT infrastructure capabilities are positively related to business process improvement. Hence, IT infrastructure reach can improve the efficiency of operational processes through automation, or enhance their effectiveness and reliability by linking them together. With the advances in information technology and changing customer demands both drive and require process innovation.

In public sector, competitive advantage plays an important role where it not only helps improve public services but also helps eliminate inefficiencies and waste (Popa *et al.*, 2011). By highlighting the effect of a project process that is referring to Howsawi *et al.* (2014), this paper emphasize the success by looking at the cost and time. Based on the finding, process innovation have approach success to the outcome of the software project process hence, to be implemented to other agencies in the public sectors. The findings of this study provide evidence that competitive advantage affects the performance of an organization (Newbert, 2008; Schroeder *et al.*, 2002). Process innovation was found to function as a mediator in the relationship between organizational capability and the success of software project process. It is hypothesised that no matter what processes of resources and capabilities are, they only indirectly affect performance. In other words, success can be only achieved if the firm secures organisational capability such as tangible, intangible and human turn them into competitive advantage. Organization must implement process innovation in such a way that can provide better quality product, shorten service delivery, improve its efficiency, develop new product and also manage staff knowledge and information that would attain superior performance. In addition, it is important to implement process innovation practice that support the organizational capabilities while delivering on time and within cost of software development project.

This paper has its limitations in regards is regards to quantifying and measuring a software project with unspecified budget and/or schedule. The IT Manager must be able to foresee the potential size and cost of a project and be able to derive an adequate cost and schedule estimate before manage the overall project effectively. Furthermore, it is important of discerning the programmers' productivity and required resources to keep development or maintenance costs to a minimum and deliver applications in a timely manner. Therefore, one highly touted estimating methodology, function point analysis will give IT Managers a means to determine resources early in the software development life cycle. For future studies, IT Manager could perhaps estimate development time, programmer productivity and or process improvement accurately to deliver the software development project on time and within cost.

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